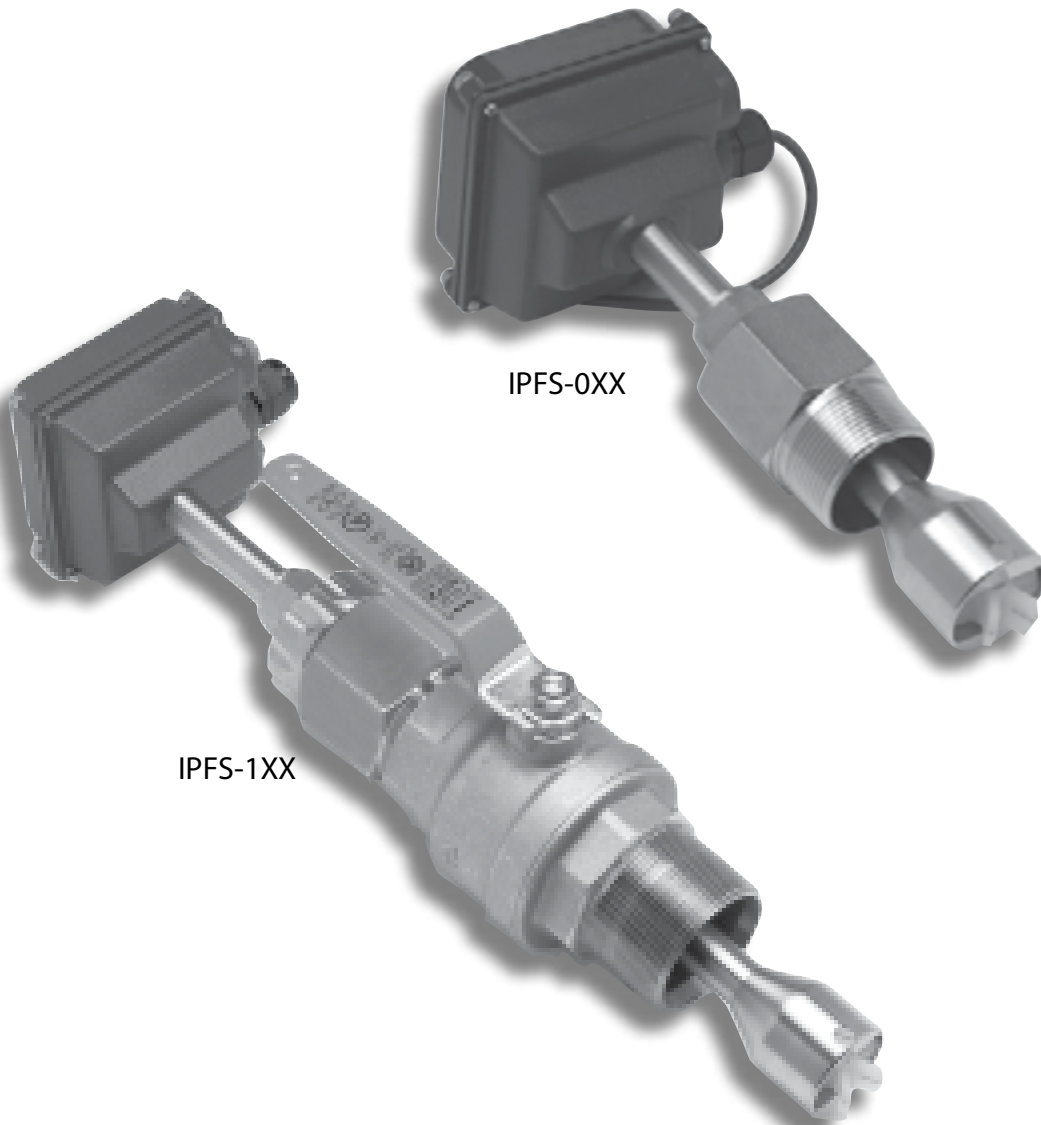




SERIES IPFS

ADJUSTABLE DEPTH INSERTION PADDLEWHEEL INSTRUCTIONS



IPFS-0XX

IPFS-1XX

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GENERAL INFORMATION

GENERAL INFORMATION

The IPFS Series are adjustable depth insertion paddlewheels that come in brass or 316 stainless models to fit 3" to 40" pipe. Installation fittings are standard 1-1/2" or 2" NPT. Fittings such as saddles and weldolets may be purchased either locally or from Dwyer Instruments Inc.

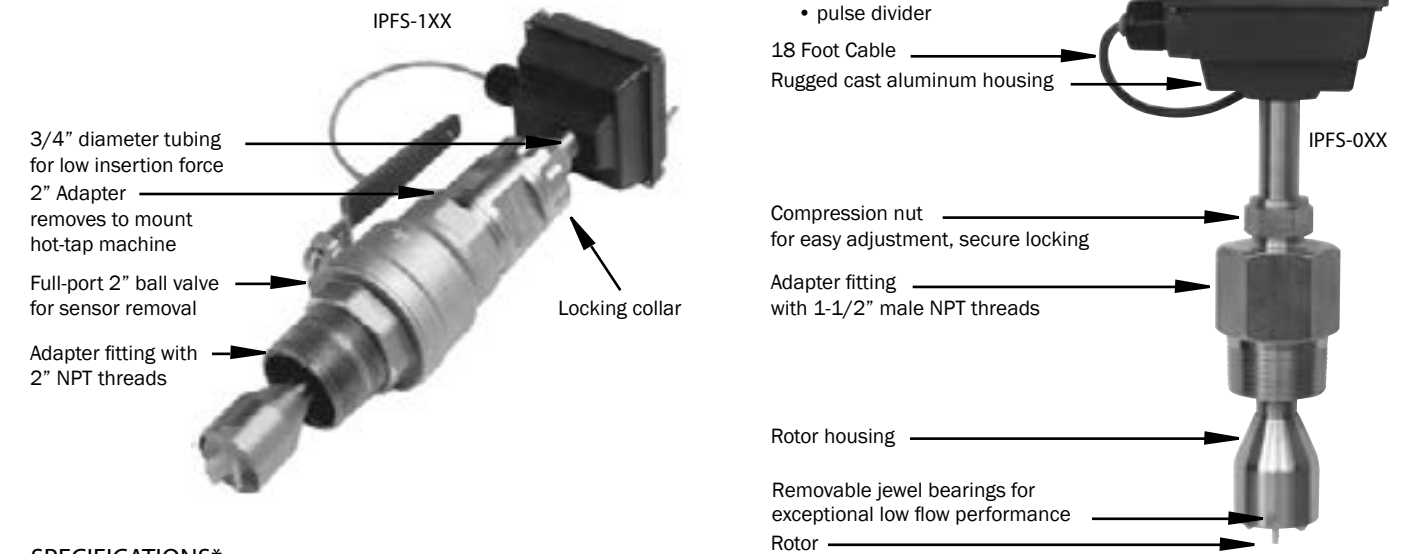
Ruby bearings and a non-drag Hall-effect sensor give these meters the widest flow range of any of the paddlewheel types. A sensor detects the passage of miniature magnets in the six rotor blades. The resulting square-wave signal can be sent for hundreds of feet over unshielded cable without a transmitter and connected directly to many PLC's and other controls without any additional electronics.

If desired, a modular system of electronics can be installed

directly on the flow sensor or mounted remotely. The Series RTI provides digital rate and total display, as well as programmable pulse output; the Series RTI also provides a 4 to 20 mA analog output. The Series BAT is a blind analog transmitter. Programmable pulse for pump pacing is available with the Series PWD.

The "hot-tap" models IPFS-1 can be installed or serviced without shutting down the line by means of a 2" full-port isolation valve that comes with a nipple for installation on the pipe fitting. In most circumstances, no special tool is required.

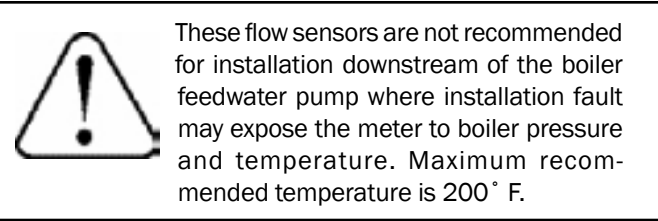
FEATURES



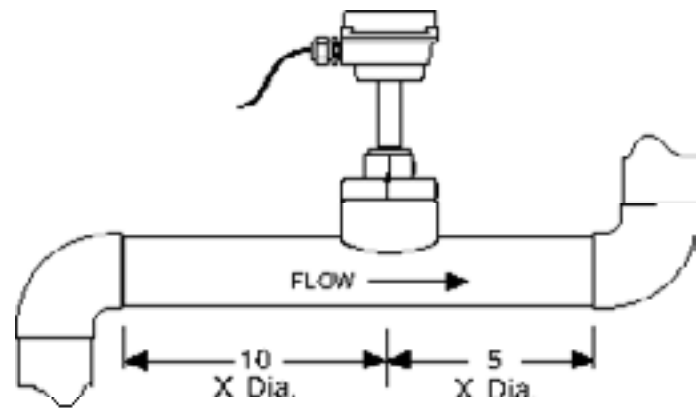
SPECIFICATIONS*

Pipe Size	S-Size	L-Size
	3" to 12" (50 - 300mm)	12" to 40" (300 - 1000mm)
Sensor	Hall Effect sensor, 12 Vdc current sinking pulse	
Materials	Housing	Cast aluminum
	Sensor Body	Brass or 316 SS
	Rotor	PVDF
	Shaft	Nickel-bound tungsten carbide (zirconia ceramic optional)
	Bearings	Ruby jewel
Isolation Valve	IPFS-0	IPFS-1
	None	Bronze (316SS optional)
Fitting Size	1.5" NPT	2" NPT
Flow Range	0.3 - 30 feet/sec (0.1 - 9 meter/sec)	
Accuracy	+/- 1.5% of full scale	
Maximum Temperature	200° F (93° C)	
Maximum Pressure	200 psi (14 bar)	
Insertion Force	0.44 x pressure in pipe	
Power	5-24 Vdc, 1.5 mA	
Cable	#22 AWG 3-con, 18' (6m); 2,000' (650m) maximum cable run	

*Specifications subject to change.

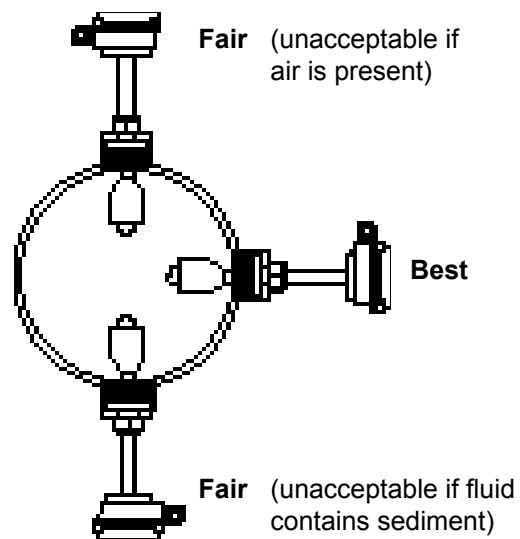


Piping. For best results, the IPFS sensor should be installed with at least ten diameters of straight pipe upstream and five diameters downstream. Certain extreme situations such as partially-opened valves are particularly difficult and may require fifteen diameters upstream. (See Straight Pipe Recommendations.)



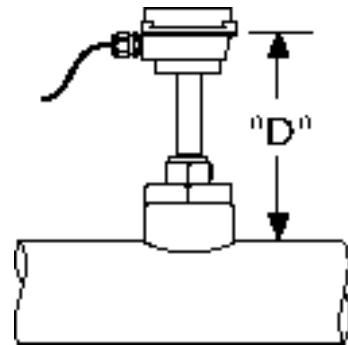
Horizontal is the preferred installation orientation, since it improves low-flow performance slightly and avoids problems with trapped air. Bottom, top, and vertical pipe installations are all acceptable if required by the piping layout. (See Full Pipe Recommendations.)

POSITIONING THE METER

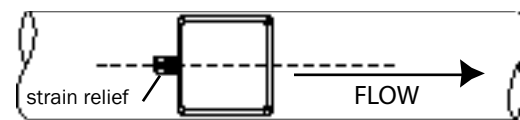


Immersion. The IPFS Series standard sensors are not designed for continuous underwater operation. If this is a possibility, as in a flooded vault, a unit modified for immersion should be specified (Option -IMM)

Depth Setting. It is important for accuracy that the sensor be inserted to the correct depth into the pipe.



1. In Table 1 (on page 4), find Dimension C for your sensor model and pipe size.
2. Subtract wall thickness of your pipe (Table 2 on page 4) to find Dimension D.
3. Measuring from the outside of the pipe to the joint in the housing, as shown in the diagram, adjust the sensor to Dimension D and hand tighten compression nut.
4. Align the conduit housing with the centerline of the pipe, as shown below. Be sure the arrow on the housing points in the direction of flow.



5. Check Dimension D one more time.
6. Tighten the compression nut fully.

RECORD YOUR SETTINGS

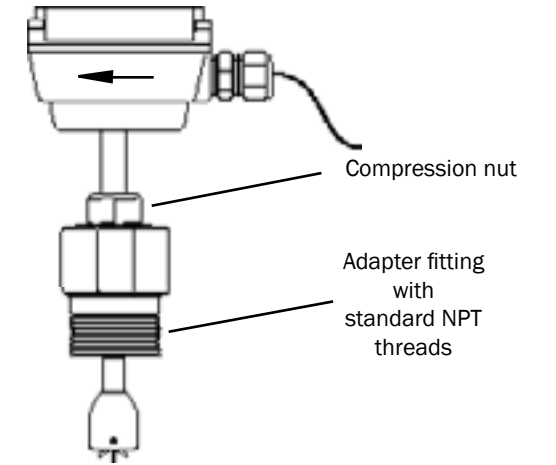
Once you have the meter set up and operational, it is important to record your meter settings and save them for future reference.

K-Factor _____
 Insertion Depth (Dim. D) _____

IPFS-0XX INSTALLATION

Fitting Installation. IPFS-0XX sensors come with a 1-1/2" male NPT pipe thread adapter fitting. Any fitting that provides the matching NPT female thread may be used. Installation procedure compensates for fitting height differences. Cut a minimum 1-3/4" hole in the pipe. If possible, measure the wall thickness and write it down for use in depth setting. Then install the threaded fitting (saddle, weldolet, etc.) on the pipe.

Meter Installation. Loosen the compression nut so that the adapter slides freely. Pull the meter fully upward and finger-tighten the compression nut. Using a thread sealant, install the adapter in the pipe fitting. Do not overtighten. Now loosen the compression nut, lower the meter to the appropriate depth setting (see diagram and instructions, preceding page). Caution: Do not allow the meter to fall into the pipe uncontrolled, as this may damage the meter. Be sure flow is in the direction of the arrow on the housing. Tighten compression nut fully.



IPFS-1XX INSTALLATION

'Hot tap' meters are designed to be installed and serviced without depressurizing the pipe.

Fitting Installation. The hot tap sensors have a 2" NPT thread for compatibility with the 2" isolation valve. Any fitting that provides matching NPT female thread may be used. The installation procedure compensates for differences in fitting height.

If initial installation is performed on an unpressurized pipe, cut a minimum 1-3/4" hole in the pipe. If possible, measure the wall thickness and write it down for use in depth setting. Then install the threaded fitting (saddle, weldolet, etc.) on the pipe.

If it is necessary to do the initial installation under pressure, any standard hot tap drilling machine with 2" NPT adapter, such as a Transmate or a Mueller, can be used. Ordinarily, it is not necessary to use an installation tool, since the small-diameter tube can be controlled by hand but not for higher pressures.

Meter Installation. Remove the sensor unit from the valve assembly. Using a thread sealant, install the valve assembly on the pipe fitting. If the initial installation is a pressure ("hot") tap, remove the 1-1/2" x 2" adapter bushing at the back of the valve. Thread the tapping machine on, open the valve, and tap using a minimum of 1-3/4" or maximum 1-7/8" cutter. After retracting the machine and closing the valve, reinstall the flow sensor. When the sensor is secure, open the valve and adjust depth setting (see diagram and instructions, preceding page). Be sure flow is in the direction of the arrow on the housing. Tighten locking collar and compression nut fully.

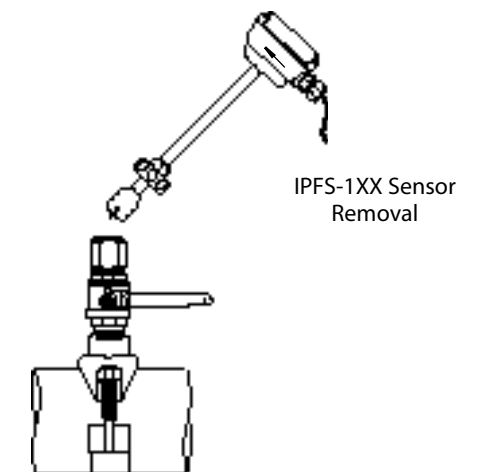
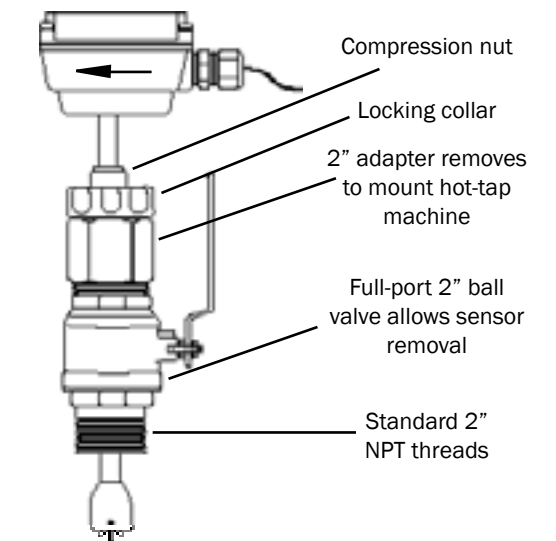
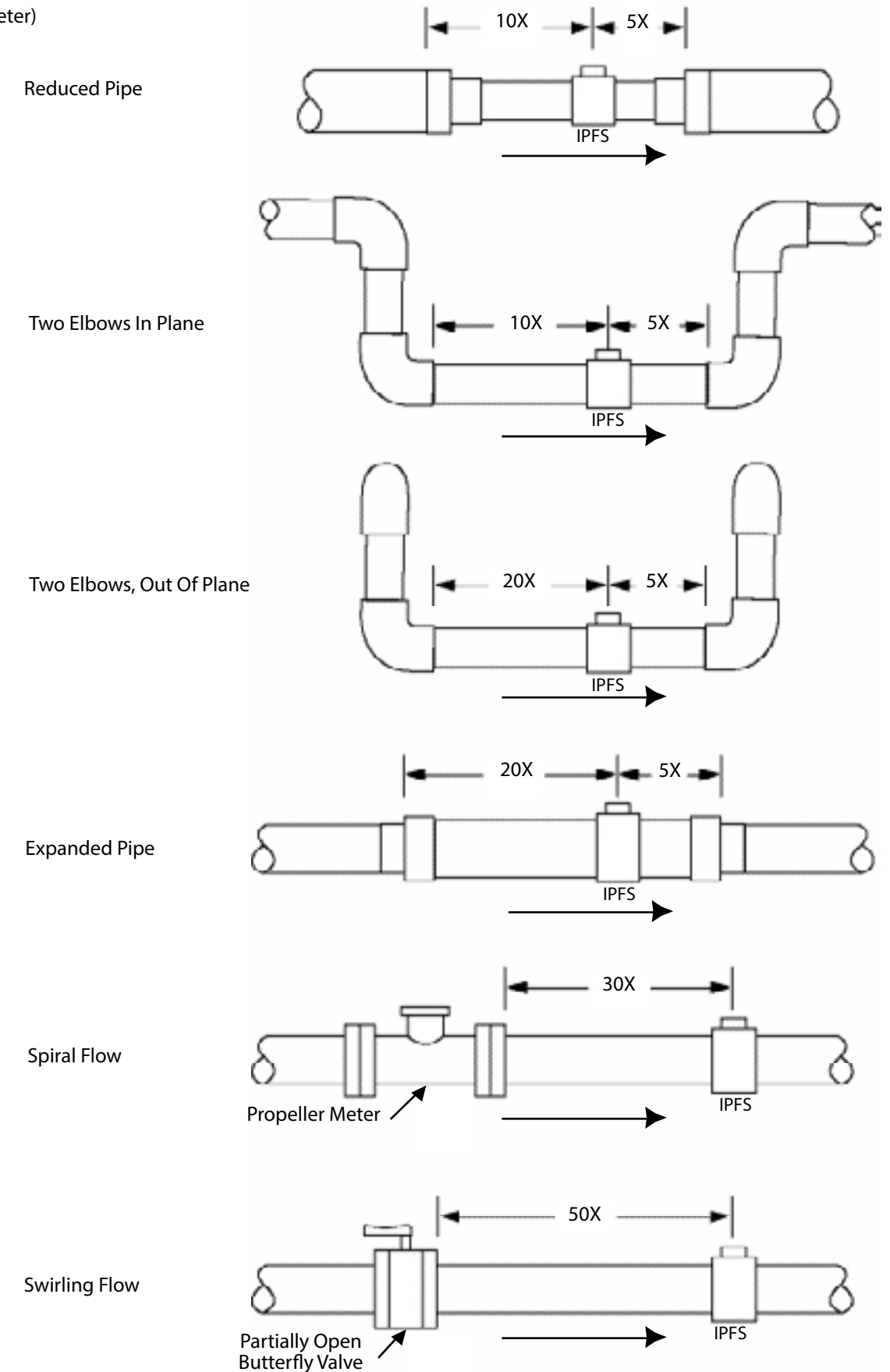


Table 1: Dimension "C"										
Nominal Pipe Size										
	3"	4" 6"	8"	10"	12"	16"	24"	30"	36"	
IPFS-0-S	9.20	9.03	8.69	8.35	8.01	7.67	6.99	-	-	-
IPFS-0-L	14.20	14.03	13.69	13.35	13.01	12.67	11.99	10.63	9.61	9.59
IPFS-1-S	16.21	16.01	15.71	15.31	15.01	14.7	14.01	-	-	-
IPFS-1-L	-	20.06	19.66	19.36	19.06	18.66	17.96	16.66	15.66	14.56

Table 2: Pipe Wall Thickness										
Nominal Pipe Size										
	3"	4"	6"	8"	10"	12"	16"	24"	30"	36"
PVC/Steel Sch. 40	0.216	0.237	0.280	0.322	0.365	0.406	0.500	0.687	-	-
PVC/Steel Sch. 80	0.300	0.337	0.432	0.500	0.593	0.687	0.843	1.218	-	-
Stainless Steel (10S)	0.120	0.120	0.134	0.148	0.165	0.180	-	-	-	-
Stainless Steel (40S)	0.216	0.237	0.280	0.322	0.365	0.375	0.375	0.375	0.375	-
Copper Tubing (Type L)	0.090	0.100	0.140	0.200	0.250	0.280	-	-	-	-
Copper Tubing (Type K)	0.109	0.134	0.192	0.271	0.338	0.405	-	-	-	-
Brass Pipe	0.219	0.250	0.250	0.313	0.365	0.375	-	-	-	-
Duct. Iron (Class 52)	0.280	0.290	0.310	0.330	0.350	0.370	0.400	0.440	0.470	0.530

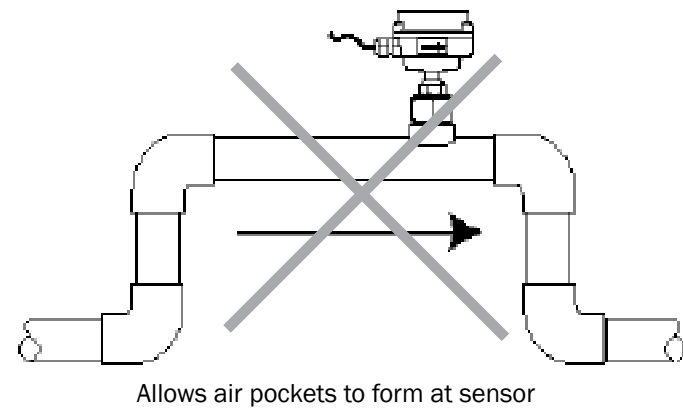
STRAIGHT PIPE RECOMMENDATIONS

(X = diameter)

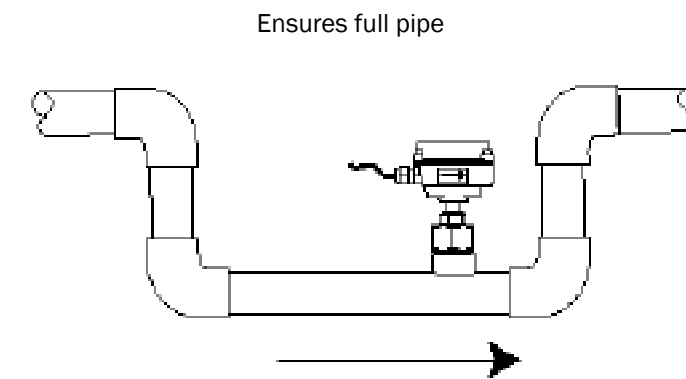


FULL PIPE RECOMMENDATIONS

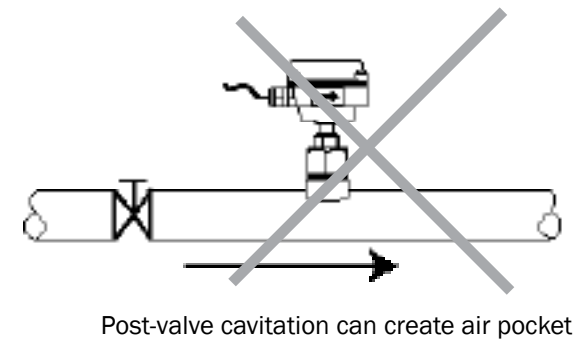
NOT RECOMMENDED



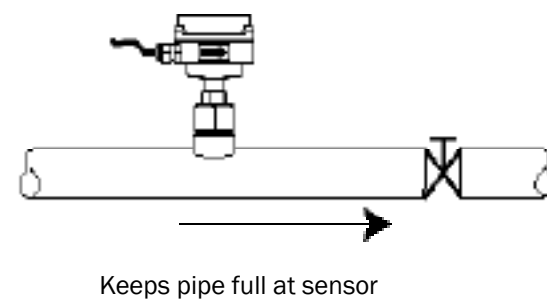
RECOMMENDED



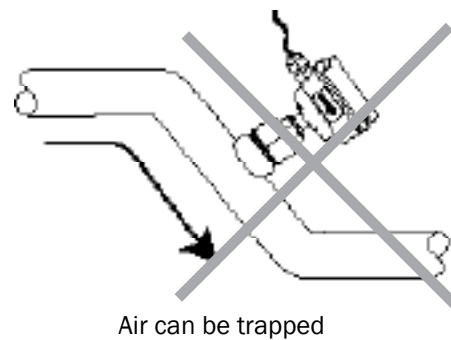
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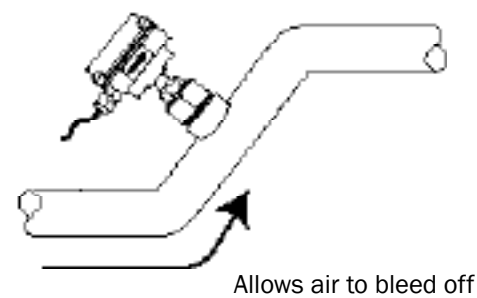
RECOMMENDED



NOT RECOMMENDED



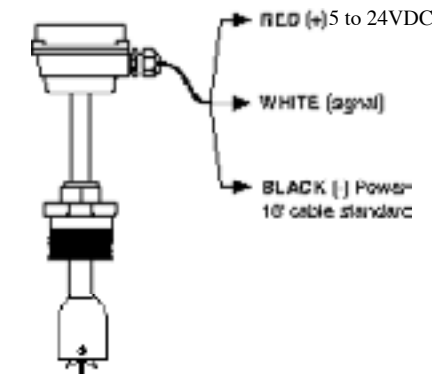
RECOMMENDED



Caution: These flow sensors are not recommended for installation downstream of the boiler feedwater pump where installation fault may expose the flow sensor to boiler pressure and temperature. Maximum recommended temperature is 200°F.

CONNECTION

Sensors are supplied with 18 ft. of cable. For sensors with no additional electronics, see diagram for color coding of connections. For sensors with on-board electronics, see the manual accompanying the electronic module.



Calibration ("K-Factor"). In order to properly process pulses from the flow sensor, a number must be entered into the control to which the sensor is connected. This number, called the K-factor, is the number of pulses the sensor puts out per unit of fluid passing through the pipe. It is normally provided for Seametrics sensors in pulses per gallon, and is given on the chart "K-factors for Various Pipe Sizes." These numbers are based on extensive testing, which has shown close agreement between different IP sensors in the same installation. Typically, most K-factor error can be attributed to installation variables, such as depth setting and fitting configuration.

It is occasionally possible to field calibrate a sensor by catching the fluid in a measured container and comparing with the number of pulses recorded. (To record individual pulses, set the K-factor on the control to 1.00.) This is especially desirable if the installation has less than the recommended length of straight pipe upstream of the sensor.

Table 3: IPFS K-factors

	Nominal Pipe Size									
	3"	4"	6"	8"	10"	12"	16"	24"	30"	36"
PVC/Steel Sch. 40	34.246	19.221	7.830	4.611	2.883	1.859	1.224	.577	-	-
PVC/Steel Sch. 80	38.329	21.844	8.779	4.980	3.213	2.097	1.304	.656	-	-
Stainless Steel (10S)	30.331	16.581	7.045	4.270	2.621	1.703	1.160	.519	.332	-
Stainless Steel (40S)	34.246	19.221	7.830	4.611	2.883	1.836	-	-	-	-
Copper Tubing (Type K)	38.145	21.420	8.846	5.027	3.302	2.126	-	-	-	-
Copper Tubing (Type L)	37.167	20.774	8.505	4.873	3.167	2.011	-	-	-	-
Brass Pipe	34.381	19.545	7.658	4.593	2.883	1.836	-	-	-	-
Duct. Iron (Class 52)	28.137	16.994	7.238	4.213	2.633	1.681	1.065	.461	.297	.207

OPERATION

Theory. In principle, an insertion flow sensor measures the velocity of flow at one point in the pipe, and flow rate and total can be inferred from this one point. Accuracy is decreased by any factor which makes the flow at the measured point unrepresentative of the entire flow stream. This includes distorted flow patterns caused by upstream fittings too close to the sensor. The worst offenders are fittings that increase the flow on one side of the pipe, such as partially-opened gate or butterfly valves. Fluid moving in a pipe does not all flow at the same velocity. Toward the center of the pipe, fluid moves faster than at the wall, and the relationship between the two changes as overall flow rate increases. This change in the "velocity profile" can result in non-linearity, which means that the K-factor that is correct for one flow rate may be incorrect for another. The recommended depth settings have been carefully chosen to minimize this source of error, and should be followed carefully, especially in the smaller pipe sizes.

Flow Range. These sensors are designed to operate at flow velocities of 0.3 to 30 feet per second. If erratic readings are encountered at low flows, check the chart to see if flow is below minimum for the pipe size. The standard shaft and bearings should have a long life at continuous high flow.

WARRANTY/RETURN

Refer to "Terms and Conditions of Sale" in our catalog or on our website. Contact customer service to receive a Returns Goods Authorization number before shipping your product back for repair. Be sure to include a brief description of the problem plus any relevant application notes.

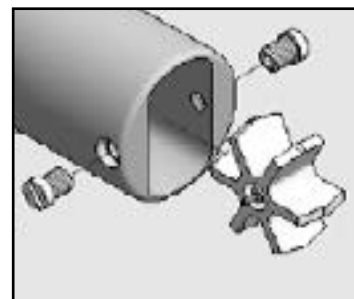
REPAIR



Caution! Never attempt to remove a flow sensor when there is pressure in the pipe unless it is specifically designed for hot tap installation and removal. Loosen the compression nut slowly to release any trapped pressure. If fluid sprays out when removing the sensor, stop turning and depressurize the pipe. Failure to do so could result in the sensor being thrown from the pipe, resulting in damage or serious injury.

Rotor Replacement. Rotors are easily field-replaced. Shaft and rotor are a single unit, and are not replaced separately. If replacement is due only to normal shaft wear, bearing replacement is probably not necessary. If the rotor has been damaged by impact, the bearings should also be replaced. Rotor and bearings can be ordered as a kit. Follow these steps:

1. Unscrew the threaded bearing housings to expose the shaft ends. If bearings are being replaced, back them completely out.
2. Remove the rotor. Put the new rotor in its place.
3. Thread in one bearing housing part way, then the other. Take care to start the end of the shaft into the bearing hole before tightening further.
4. Screw in bearing housings until they bottom. Note: Do not use excessive force.
5. Check for free spin. Blowing lightly on the rotor should result in it spinning rapidly and coasting to a smooth stop.

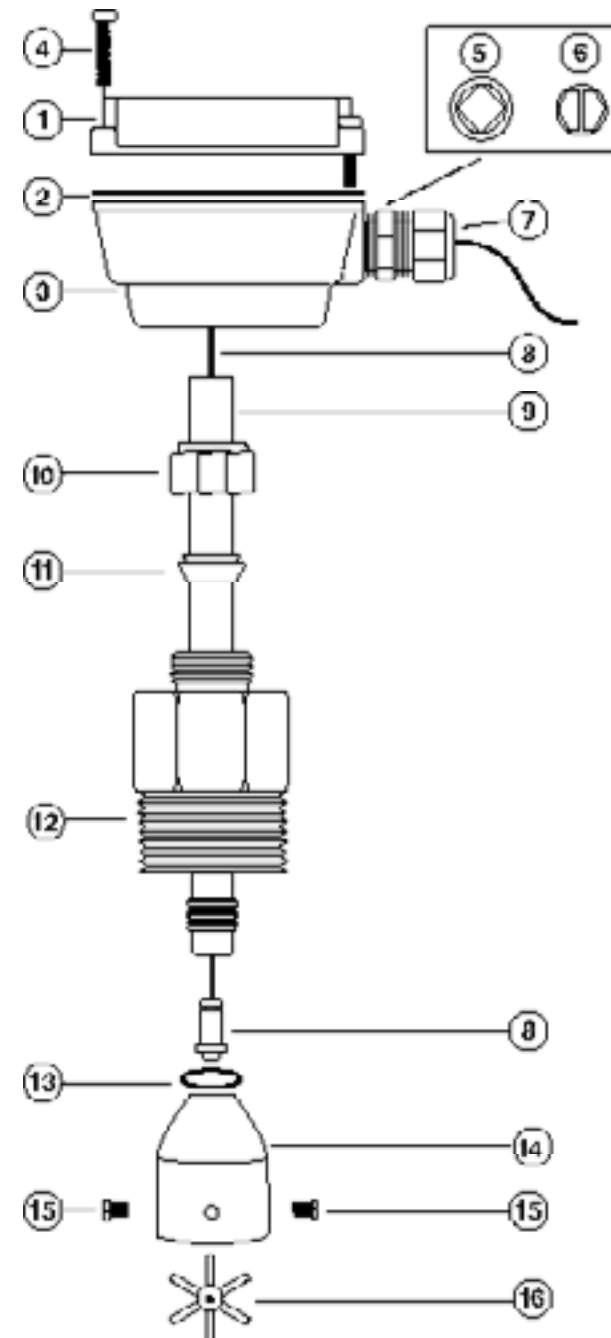


Signal

The flow sensor has only one moving part, the rotor. If this is turning properly and there is no signal, the Hall-effect sensor is not operating properly. To check the signal, apply 12 Vdc regulated* power to the red (+) and black (-) leads. Set a multimeter to voltage reading. Put the positive multimeter lead on the red wire and the negative lead on the white wire. Slowly turn the rotor. Voltage reading should swing between +12 Volts and 0 Volts as the rotor turns. If it does not, the Hall effect sensor is not working properly. Checking for continuity is not a useful test of these sensors.

*NOTE: An unregulated power supply can exceed max voltage of micro powered sensor (gray cable) and damage sensor.

Parts Explosion



IPFS-0XX Parts	
1	Upper housing assembly
2	Gasket
3	Lower housing
4	Housing screw (4 req'd)
5	Plug, steel
6	Plug, plastic
7	Strain relief
8	Pickup, Standard (for RTI)
9	Tube
10	Compression nut
11	Compression ferrule
12	Adapter fitting
13	Rotor housing O-ring (EPDM)
14	Rotor housing
15	Jewel bearings (2 req)
16	Rotor with shaft
17	Rotor repair kit (includes of #15 & #16)

IPFS-1XX (HOT-TAP) Parts (not shown)	
	Adapter fitting
	Ball valve assembly
	Collar, locking
	Hex nipple, 2"

TROUBLESHOOTING

Problem	Probable Cause	Try...
No pulse output	<p>Below minimum flow cutoff</p> <p>Empty pipe</p> <p>No power</p>	<p>Check Table for velocity vs. pipe size</p> <p>Check plumbing</p> <p>Check connections</p>
Output pulses incorrect	<p>Incorrect depth setting</p> <p>Pipe not full</p> <p>Not enough straight pipe</p>	<p>Check depth setting from Dimension "C" table</p> <p>Refer to Installation/diagrams</p> <p>Refer to Installation/diagrams</p>
Jumpy reading	<p>Fluctuating flow rate</p> <p>Fluctuating around low flow cutoff</p> <p>Not enough straight pipe</p>	<p>Refer to installation diagrams</p> <p>Check Table for velocity vs. pipe size</p> <p>Refer to Installation/diagrams</p>

